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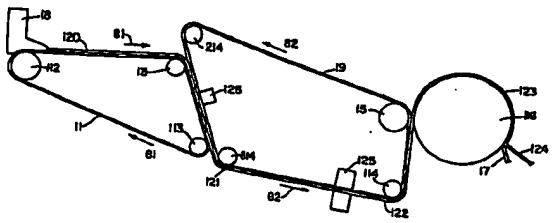
(54) Process for the manufacture of paper web, and use of the paper web

(57) The present invention relates to a process for the manufacture of a paper web comprising the steps of:

(a) providing an aqueous dispersion of papermaking fibres;
(b) forming an embryonic web (120) of the papermaking fibres from the dispersion on a first foraminous member (11);
(c) transferring the embryonic web (120) to a second foraminous member (19), the second foraminous member (19) comprising an embryonic web-contacting surface comprising a macroscopically monoplanar, patterned, continuous network surface defining within the second foraminous (19) member a plurality of discrete, isolated, deflection conduits (16);
(d) removing water from the embryonic web on the second foraminous member (19) to form an intermediate web (122), wherein the step of water removal deflects the papermaking fibres in the embryonic web into the deflection conduits (16) and whereby water is removed from the embryonic web through the conduits (16) to form an intermediate web (122) of the papermaking fibres;
(e) optionally, drying the intermediate web;
wherein the average density of the deflection conduits (16) is greater than 0.6 conduits per square millimeter (about 400 conduits per square inch), and by the further step of embossing the dried paper web (124) to form a pattern of embossed sites, the pattern of embossed sites having a density of at least 0.03 embossed sites per square millimeter (about 20 embossed sites per square inch).

The present invention also relates to paper webs produced by this process, and to improved cleaning performance of those paper webs in use.

Fig. 1



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Description

[0001] The present invention relates to a process for the manufacture of a paper web, to the paper web and to the use of the paper web. In particular the invention relates to personal cleaning products such as toilet tissue, facial tissue, skin care articles for cosmetic and therapeutic purposes, paper towels, and dry wipes. Such items are a staple of everyday life. The large demand and constant usage for such consumer products has created a demand for improved versions of these products.

[0002] It has long been recognised that three important physical attributes of these products are their softness; their absorbency; and their strength. Research and development efforts have been directed to the improvement of each of these attributes without deleteriously affecting the others as well as to the improvement of two or three attributes simultaneously.

[0003] Softness is the tactile sensation perceived by the consumer as he/she holds a particular product, rubs it across his/her skin, or crumples it within his/her hand. This tactile sensation is a combination of several physical properties. One of the more important physical properties related to the softness is generally considered by those skilled in the art to be the stiffness of the paper tissue from which the product is made. Stiffness, in turn, is usually considered to be directly dependent on the dry tensile strength of the web.

[0004] Strength is the ability of the product to maintain physical integrity and to resist tearing, bursting, and shredding under use conditions.

[0005] Absorbency is the measure of the ability of a product to absorb quantities of liquid, particularly aqueous solutions or dispersions. Overall absorbency as perceived by the human consumer is generally considered to be a combination of the total quantity of a liquid a given mass of tissue paper will absorb at saturation as well as the rate at which the mass absorbs the liquid.

[0006] US-A-4 637 859, issued on 20th January 1987 discloses a process for the manufacture of a paper web comprising the steps of:

(a) providing an aqueous dispersion of papermaking fibres

(b) forming an embryonic web of the papermaking fibres from the dispersion on a first foraminous member;

(c) transferring the embryonic web to a second foraminous member, the second foraminous member comprising an embryonic web-contacting surface comprising a macroscopically monoplanar, patterned, continuous network surface defining within the second foraminous member a plurality of discrete, isolated, deflection conduits;

(d) removing water from the embryonic web on the second foraminous member to form an intermediate web, wherein th step f water removal deflects the papermaking fibres in the embryonic web into the deflection conduits and whereby water is removed from the embryonic web through the conduits to form an intermediate web of the papermaking fibres;

(e) optionally, drying the intermediate web;

WO95/08671, published on 30th March 1995, discloses a step of embossing a pattern on to a paper web.

[0007] These prior art references disclose preferred processes for making paper webs which have the attributes previously referred to, namely: softness, strength and absorbency. These, and other prior art references do not, however, suggest that these processes can be optimised in order to improve cleaning performance. Nevertheless it is cleaning performance which is a crucial attribute of the paper webs described herein.

[0008] It is, therefore, an object of the invention to provide a process for making a paper web which improves cleaning performance.

Summary of the Invention

[0009] The object of the invention is achieved by an average density of the deflection conduits which is greater than 0.6 conduits per square millimeter (400 conduits per square inch), and by the further step of embossing the dried paper web (124) to form a pattern of embossed sites, the pattern of embossed sites having a density of at least 0.03 embossed sites per square millimeter (about 20 embossed sites per square inch).

[0010] The invention also relates to a paper web having a basis weight of at least 50 g/m^2 (about 30 lbs per 3000 square feet), the paper web having a micropattern comprising raised elements with a density of greater than 0.6 conduits per square millimeter (about 400 conduits per square inch), and additionally having an embossed macropattern, the pattern of embossed sites having a density of at least 0.03 embossed sites per square millimeter.

[0011] The invention also provides for the use of a paper web for improved cleaning performance having a micropattern comprising raised elements with a density of greater than 0.6 conduits per square millimeter, and having an embossed macropattern, the pattern of embossed sites having a density of at least 0.03 embossed sites per square millimeter. Preferably the paper web is used as a personal cleansing product such as toilet tissue, facial tissue, skin care articles for cosmetic and therapeutic purposes, paper towels, and dry wipes, most preferably a toilet tissue.

[0012] It is preferred that the pattern of embossed sites has a density of from 0.04 to 0.22 embossed sites per square millimeter, and more preferred that the ratio of the average density of the embossed sites to the average density of the deflection conduits is from 8:1 to 32:1, most pr ferred is from 12:1 to 24:1.

[0013] It is also preferred that the pattern of embossed sites is bilaterally staggered in a pattern having a principal axis 45° from the machine direction of manufacture, nested embossing being most preferred.

Brief Description of the Drawings

[0014]

Figure 1 is a schematic representation of one embodiment of a continuous papermaking machine which is suitable for use in the present invention.

Figure 2 is a section through an imprinting belt which is suitable for use in the present invention.

Figure 3 is a plan view of the more preferred embossing pattern on the paper web.

Detailed Description of the Invention

[0015] The present invention relates to a process for the manufacture of a paper web comprising the steps of providing an aqueous dispersion of papermaking fibres or "furnish", and forming an embryonic web of the papermaking fibres from the dispersion on a first foraminous member.

[0016] The embryonic web is subsequently transferred to a second formainous member comprising an embryonic web-contacting surface comprising a macroscopically monoplanar, patterned, continuous network surface defining within the second foraminous member a plurality of discrete, isolated, deflection conduits.

[0017] The first and second foraminous members are normally separate and distinct members, and there may be other members placed between the first and second member. Alternatively the first and second foraminous members may be a single member. However it is preferred that the embryonic web is transferred directly from the first foraminous member to the second foraminous member.

[0018] By "paper web" what is meant herein is a structure comprising one or more laminae or "plies" of nonwoven fibrous material.

[0019] By "imprinted" what is meant herein is that a pattern is formed onto the paper web by the step of water removal and, at the same time, deflecting the papermaking fibres in the embryonic web into the deflection conduits and whereby water is removed from the embryonic web through the conduits to form an intermediate web of the papermaking fibres. The deflection conduits which imprint the micropattern have a density of at least 0.6 conduits per square millimetre, preferably at least 0.7 to 1.5 conduits per square millimetre. In addition to the pattern formed by the discrete, isolated, deflection conduits, a larger pattern may, optionally, also be imprinted onto the paper web for aesthetic effect, as disclosed in US-A-5 328 565, issued July 12, 1994.

[0020] By "embossing" what is meant herein is the process of deflecting a relatively small portion of a paper web normal to its plane and impacting the projected portion of the paper web against a relatively hard surface to permanently disrupt the fibre to fibre bonds. Embossing typically results in a permanent localised deformation on the "embossed site" so deflected. The embossed site projects normal to the plane of the paper web. Embossing, unlike imprinting, is typically carried out on a dried paper web.

[0021] The process for making the imprinted paper web, according to the present invention, typically involves the steps of depositing a papermaking furnish on a foraminous forming wire such as a Fourdrinier wire to form a wet web and the juxtaposing the web against an array of supports. The web is pressed against the array of supports, thereby resulting in densified zones in the web at the locations geographically corresponding to the points of contact between the array of supports and the web. The remainder of the web not compressed during this operation is referred to as the high bulk field. This high bulk field can be further dedensified by application of fluid pressure, such as with a vacuum type device or a blow-through dryer, or by mechanically pressing the web against the array of supports. The web is dewatered, and optionally predried, in such a manner so as to avoid compression of the high bulk field. This is preferably accomplished by fluid pressure, such as with a vacuum type device or a blow-through dryer, or alternately by mechanically pressing the web against the array of supports wherein the high bulk field is not compressed. The operations of dewatering, optional predrying and formation of the densified zones may be integrated or partially integrated to reduce the total number of processing steps performed. Subsequent to formation of the densified zones, dewatering, and optional predrying, the web is dried to completion, preferably still avoiding mechanical pressing. Preferably, from about 8% to about 55% of the tissue paper surface comprises densified knuckles having a relative density of at least 125% of the density of the high bulk field.

[0022] The array of supports is preferably an imprinting carrier fabric having a patterned placement of knuckles which operate as the array of supports which facilitate the formation of the densified zones upon application of pressure. The pattern of knuckles constitutes the array of supports previously referred to. Imprinting carrier fabrics are disclosed in US-A-3 301 746, Sanford and Sisson, issued January 31, 1967; US-A-3 821 068, Salvucci, Jr. et al., issued May 21, 1974; US-A-3 9744 025, Ayers, issued August 10 1976;US-A-3 573 164, Friedberg et al., issued March 30, 1971; US-A-3 473 576, Amneus, issued October 21, 1969; US-A-4 239 065, Trokhan, issued December 16, 1980; and US-A-4 528 239, Trokhan, issued July 9, 1985.

[0023] Pref rably, the furnish is first formed into a wet web on a foraminous forming carrier, such as a

Fourdrinier wire. The web is dewatered and transferred to an imprinting fabric. The furnish may alternately be initially deposited on a foraminous supporting carrier which also operates as an imprinting fabric. Once formed, the wet web is dewatered and, preferably, thermally predried to a selected fiber consistency of between 40% and 80%. Dewatering is preferably performed with suction boxes or other vacuum devices or with blow-through dryers. The knuckle imprint of the imprinting fabric is impressed in the web as discussed above, prior to drying the web to completion.

[0024] Figure 1 illustrates a highly preferred continuous process comprising:

(a) means 18 for providing an aqueous dispersion of papermaking fibres;
(b) forming an embryonic web 120 of the papermaking fibres from the dispersion on a first foraminous member 11 which travels in direction 81 around rolls 13, 113, 112;
(c) means 126 for transferring the embryonic web 120 to a second foraminous member 19, the second foraminous member 19 travels in direction 82 around rolls, 15, 114, 214, 314;
(d) means 125 for removing water from the embryonic web 121 on the second foraminous member to form an intermediate web 122; and
(e) drying the intermediate web 122 on a Yankee dryer 116, to form a dried web 123, which is removed from the Yankee dryer 116 by means of a doctor blade 17, to produce a paperweb 124.

[0025] According to the present invention the paper web 124 is also embossed (not shown in Figure 1).

[0026] Figure 2 illustrates a highly preferred imprinting belt 10 which comprises two primary components: a framework 12 and a reinforcing structure 14. The framework 12 preferably comprises a cured polymeric photosensitive resin. The framework 12 and belt 10 have a first surface which defines the paper contacting side of the belt 10 and an opposed second surface oriented towards the papermaking machine on which the belt 10 is used.

[0027] Preferably the framework 12 defines a predetermined pattern, which imprints a like pattern onto the paper 20 of the present invention. A particularly preferred pattern for the framework 12 is an essentially continuous network. If the preferred essentially continuous network pattern is selected for the framework 12, discrete deflection conduits 16 will extend between the first surface and the second surface of the belt 10. The essentially continuous network surrounds and defines the deflection conduits 16.

[0028] The papermaking belt 10 according to the present invention is macroscopically monoplanar. The plane of the papermaking belt 10 defines its X-Y directions. Perpendicular to the X-Y directions and the plane of the papermaking belt 10 is the Z-direction of the belt 10. Likewise, the paper 20 according to the present invention can be thought of as macroscopically monoplanar and lying in an X-Y plane. Perpendicular to the X-Y directions and the plane of the paper 20 is the Z-direction of the paper 20.

[0029] The first surface of the belt 10 contacts the paper 20 carried thereon. During papermaking, the first surface of the belt 10 imprints a pattern onto the paper 20 corresponding to the pattern of the framework 12.

[0030] The second surface of the belt 10 is the machine contacting surface of the belt 10. The second surface may be made with a backside network having passageways therein which are distinct from the deflection conduits 16. The passageways provide irregularities in the texture of the backside of the second surface of the belt 10. The passageways allow for air leakage in the X-Y plane of the belt 10, which leakage does not necessarily flow in the Z-direction through the deflection conduits 16 of the belt 10.

[0031] The second primary component of the belt 10 according to the present invention is the reinforcing structure 14. The reinforcing structure 14, like the framework 12, has a first or paper facing side and a second or machine facing surface opposite the paper facing surface. The reinforcing structure 14 is primarily disposed between the opposed surfaces of the belt 10 and may have a surface coincident the backside of the belt 10. The reinforcing structure 14 provides support for the framework 12. The reinforcing component is typically woven, as is well known in the art. The portions of the reinforcing structure 14 registered with the deflection conduits 16 prevent fibers used in papermaking from passing completely through the deflection conduits 16 and thereby reduces the occurrences of pinholes. If one does not wish to use a woven fabric for the reinforcing structure 14, a nonwoven element, screen, net, or a plate having a plurality of holes therethrough may provide adequate strength and support for the framework 12 of the present invention.

[0032] The depth of the deflectionconduits, i.e. the distance between the papermaking side of the reinforcing structure and the first surface of the belt is the "overburden". The overburden is typically between 0.3 mm and 0.6 mm.

[0033] The belt 10 according to the present invention may be made according to any of commonly assigned US-A-4,514,345, issued April 30, 1985 to Johnson et al.; US-A-4,528,239, issued July 9,1985 to Trokhan; US-A-5,098,522, issued March 24, 1992; US-A-5,260,171, issued Nov. 9, 1993 to Smurkoski et al.; US-A-5,275,700, issued Jan. 4, 1994 to Trokhan; US-A-5,328,565, issued July 12, 1994 to Rasch et al.; US-A-5,334,289, issued Aug. 2, 1994 to Trokhan et al.; US-A-5,431,786, issued July 11, 1995 to Rasch et al.; US-A-5,496,624, issued March 5, 1996 to Stelljes, Jr. et al.; US-A-5,500,277, issued March 19, 1996 to Trokhan et al.; US-A-5,514,523, issued May 7, 1996 to Trokhan et al.; US-A-5,554,467, issued Sept. 10, 1996, to Trokhan

et al.; US-A-5,566,724, issued Oct. 22, 1996 to Trokhan et al.; US-A-5,624,790, issued April 29, 1997 to Trokhan et al.; and US-A-5,628,876, issued May 13, 1997 to Ayers et al., the disclosures of which are incorporated herein by reference.

[0034] Suitable embossing steps will now be described in more detail. Preferably embossing is performed by a process referred to as nested embossing. In nested embossing, two paper webs are embossed between mated pressure rolls and pattern rolls. The pressure rolls and pattern rolls are juxtaposed with parallel axes to form three nips, a first nip between the bottom pressure roll and the bottom pattern roll, a second nip between the bottom pressure roll and the bottom pattern roll, and a third nip between the top and bottom pattern rolls. The pattern rolls have protruberances which extend radially outwardly and contact the periphery of the respective pressure rolls at the respective nips. Each paper web is fed through one of the nips between the pattern roll and the respective pressure roll. Each paper web is embossed in the nip by the protruberances of the respective pattern roll. After embossing, one of the paper webs has adhesive applied to the resulting embossed sites by an adhesive applicator roll. The adhesive applicator roll may be utilized in conjunction with either web. In this process, the embossed sites are the only portion of the web to which adhesive is applied. Adhesive does not coat the entire surface of either web, but only the embossed sites of the lamina used in conjunction with and contacting the adhesive applicator roll. The webs, one web having adhesive applied to the embossed sites, are then fed through the nip between the top and bottom pattern rolls. In this nip, the laminae are juxtaposed in face-to-face relationship, with the embossed sites of each web registered with the non-embossed sites of the other web. The two webs are then fed through a nip between the pattern roll associated with the adhesive applicator roll and a ply bonding roll, to insure the embossed sites having the adhesive applied from the adhesive applicator roll are securely in contact with and joined to the non-embossed region of the opposing web.

[0035] In an alternative embossing process the protruberances of each pattern roll are registered with the protruberances of the other pattern roll. This alternative process is known as knob-to-knob embossing.

[0036] According to the present invention, use is made of a repeating embossing pattern on a paper web to improve the cleaning performance of the paper web. A highly preferred embossing pattern, illustrated in Figure 3 is non-continuous in at least one diagonal direction and comprising discrete embossing sites. By "non-continuous" what is meant herein is that there is a line of interruption in the equidistant spacing of the embossing sites on the paper web. By "repeating" what is meant herein is that the pattern is formed more than once in the paper web. The preferred embodiment f the invention, illustrated in Figure 3, comprises an embossing pattern of an angular nature, in particular in the form of a rhombus. Nevertheless, any shape is possible and suitable shapes include, but are not limited to, polygons, semi-circles, ellipsoids etc., and any combinations thereof.

[0037] Additional process steps may also be carried out. Such steps are familiar to the skilled person. An example of a commonly used processing step is foreshortening. Foreshortening can be accomplished by creping the paper 20 from a rigid surface, and preferably from a cylinder. A Yankee drying drum 116 is commonly used for this purpose. Creping is accomplished with a doctor blade 17 as is well known in the art. Creping may be accomplished according to commonly assigned US-A- 4,919,756, issued April 24, 1992 to Sawdai. Alternatively or additionally, foreshortening may be accomplished via wet microcontraction as taught in commonly assigned US-A-4,440,597, issued April 3, 1984 to Wells et al.

[0038] When two or more individual laminae made by the above process are used to make the final paper web, they may be assembled "Yankee-side" out, or "belt-side" out. "Yankee-side" out is preferred because it presents a smoother surface which gives a better tactile sensation to the consumer.

[0039] The use of the paper web for improved cleaning performance, according to the present invention, may be dry, or it may be used for cleaning soils or spills which are dispersions, solutions or emulsions in water, or in some other solvent. The present invention has been found to be particularly effective when used as a toilet tissue for removal of faecal material.

[0040] The following method outlines the procedure for measuring the cleaning performance for the paper web.

Description of Test Procedure

Mechanical cleaning methodology

1.1 Materials

[0041]

1.1.1 DC-fix foil (ref. No. 346-0012, Konrad Hornbusch AG, 64679 Weissbach, Germany);
1.1.2 Glass plate to fix the DC-fix foil (dimensions 180 mm x 115 mm);
1.1.3 Artificial faecal material (Feclone BFPS 6, 1.3% dawn solution);
1.1.4 Glass jar with lid (dimensions: 55 mm x 95 mm) filled with lead granules to control weight;
1.1.5 Plastic slide block (dimensions: 84mm x 115 mm);
1.1.6 Speed control equipment and motor;
1.1.7 Weighing scale;
1.1.8 Spectrophotometer, CM-508 I (Min lta).

1.2 Procedure

[0042]

1.2.1 Prepare the artificial faecal material according to the manufacturer's instructions. (It is important to note that the mass must be cooled down at room temperature without mechanical help e.g. a mixer. The prepared artificial faecal material must not be stored for more than 3 days at room temperature)

1.2.2 Place the glass jar on top of the plastic slide block and adjust the total weight to 800g, by adding or removing lead granules to the jar.

1.2.3 Weigh four sheets of toilet tissue and record their weight.

1.2.4 Fold the four sheets in the middle (2 sheets over 2 sheets), fold again in the middle (area of one sheet over the area of one sheet, without perforation in the middle of the sheet). Apply the four sheets in a pile on the bottom of the plastic slide block so that the edge of the pile with two "free" ends of tissue is folded over the leading edge of the block, and the edge of the pile with two folded edges is folded over the trailing edge of the block. Retain the sheets in position with elastic band positioned around the side edges of the plastic slide block.

1.2.5 Weigh 0.8 grams of prepared artificial faecal material.

1.2.8 Mount the DC-fix foil on the glass plate and transfer the 0.8 grams of prepared faecal material directly onto the DC-fix foil, into a marked box 39 mm x 35 mm (so that the material is distributed across the area of the marked box). The front edge of the marked box is 108.5mm from the front edge of the glass plate. Measure the "colour" of the clean DC-fix foil at three points which are 35 mm, 65 mm and 95 mm from the front edge of the glass plate (along the centre line of the glass plate) using the spectrophotometer. Rest the glass plate behind two skids.

1.2.7 Take the prepared plastic slide block with the weighted bottle on top. Attach the leading edge of the plastic slide block to the motor. Put it onto the mass of prepared artificial faecal material. Place the slide so that the leading edge is 12.5 mm in front of the front edge of the marked box, and the trailing edge is 32.5 mm behind the rear edge of the marked box. Note, do not put any extra pressure onto the bottle.

1.2.8 Attach the plastic slide block to the motor and turn on the motor and draw the plastic slide block with the weighted bottle on top over the mass using a speed of 78 millimeters per second so that the plastic slide block is drawn over the DC-fix foil and onto the skids.

1.2.9 Stop the machine after 200 millimeters wiping distance, so that the plastic slide block is drawn clear of the DC-fix foil and comes to rest on the skids.

1.2.10 Leave the slide for 5 seconds.

1.2.11 Remove the used toilet tissue from the plastic slide block, weigh the tissue and record weight.

1.2.12 Measure the residues on 3 measuring points on the DC-fix foil with a spectrophotometer. The measuring points are on the middle area of residual streak, 35 mm, 65 mm and 95 mm from the front edge of the glass plate, as before.

Note:

[0043]

Clean the DC-fix foil after every measurement.
Mix the artificial faecal material at least one daybefore placing on slide.

[0044] The efficacy of cleaning is determined by using the spectrometer data to calculate the residual "colour" intensity (the delta E value) on the DC-fix foil.

Claims

1. A process for the manufacture of a paper web comprising the steps of:

(a) providing an aqueous dispersion of papermaking fibres;
(b) forming an embryonic web (120) of the papermaking fibres from the dispersion on a first foraminous member (11);
(c) transferring the embryonic web (120) to a second foraminous member (19), the second foraminous member (19) comprising an embryonic web-contacting surface comprising a macroscopically monoplanar, patterned, continuous network surface defining within the second foraminous (19) member a plurality of discrete, isolated, deflection conduits (16);
(d) removing water from the embryonic web on the second foraminous member (19) to form an intermediate web (122), wherein the step of water removal deflects the papermaking fibres in the embryonic web into the deflection conduits (16) and whereby water is removed from the embryonic web through the conduits (16) to form an intermediate web (122) of the papermaking fibres;
(e) optionally, drying the intermediate web;
characterised in that the average density of the

deflection conduits (16) is greater than 0.6 conduits per square millimeter, and by the further step of embossing the dried paper web (124) to form a pattern of embossed sites, the pattern embossed sites having a density of at least 0.03 embossed sites per square millimetre.

2. A process for the manufacture of the paper web according to claim 1 wherein the pattern of embossed sites has a density of from 0.04 to 0.22 embossed sites per square millimetre.

3. A process for the manufacture of the paper web according to claim 2 wherein ratio of the average density of the embossed sites to the average density of the deflection conduits is from 8:1 to 32:1.

4. A process for the manufacture of the paper web according to claim 1 wherein the pattern of embossed sites is bilaterally staggered in a pattern having a principal axis 45° from the machine direction of manufacture.

5. A process for the manufacture of the paper web according to any claims 1 to 4, wherein the embossing step is a nested embossing step.

6. A paper web having a basis weight of at least 50 g/m^2 (about 30 lbs per 3000 square feet), the paper web having an imprinted micropattern comprising raised elements with a density of greater than 0.6 conduits per square millimeter, and characterised in that the paper web further has an embossed macropattern, the embossed micropattern having a density of at least 0.03 embossed sites per square millimetre.

7. A paper web according to claim 6 wherein the pattern of embossed sites has a density of from 0.04 to 0.22 embossed sites per square millimetre.

8. A paper web according to claim 7 wherein ratio of the average density of the embossed sites to the average density of the deflection conduits is from 8:1 to 32:1.

9. A paper web according to claim 6 wherein the pattern of embossed sites is bilaterally staggered in a pattern having a principal axis 45° from the machine direction of manufacture.

10. A paper web according to any claims 6 to 9, wherein the embossed macropattern is a nested embossing pattern.

11. Use of a paper web for improved cleaning performance, the paper web having an imprinted micropattern comprising raised elements with a density of greater than 0.6 conduits per square millimeter, and characterised in that the pap r web further has an embossed macropattern, the embossed macropattern having a density of at least 0.03 embossed sites per square millimetre.

12. Use, according to claim 11, of a paper web wherein the macropattern of embossed sites has a density of from 0.04 to 0.22 embossed sites per square millimetre.

13. Use, according to claim 12, of a paper web wherein ratio of the average density of the embossed sites to the average density of the deflection conduits is from 8:1 to 32:1.

14. Use, according to claim 11, of a paper web wherein the macropattern of embossed sites is bilaterally staggered in a pattern having a principal axis 45° from the machine direction of manufacture.

15. Use, according to any claims 11 to 14, wherein the embossed macropattern is a nested embossing pattern.

16. Use, according to any of claims 11 to 15 of a paper web as a personal cleansing product such as toilet tissue, facial tissue, skin care articles for cosmetic and therapeutic purposes, paper towels, and dry wipes.

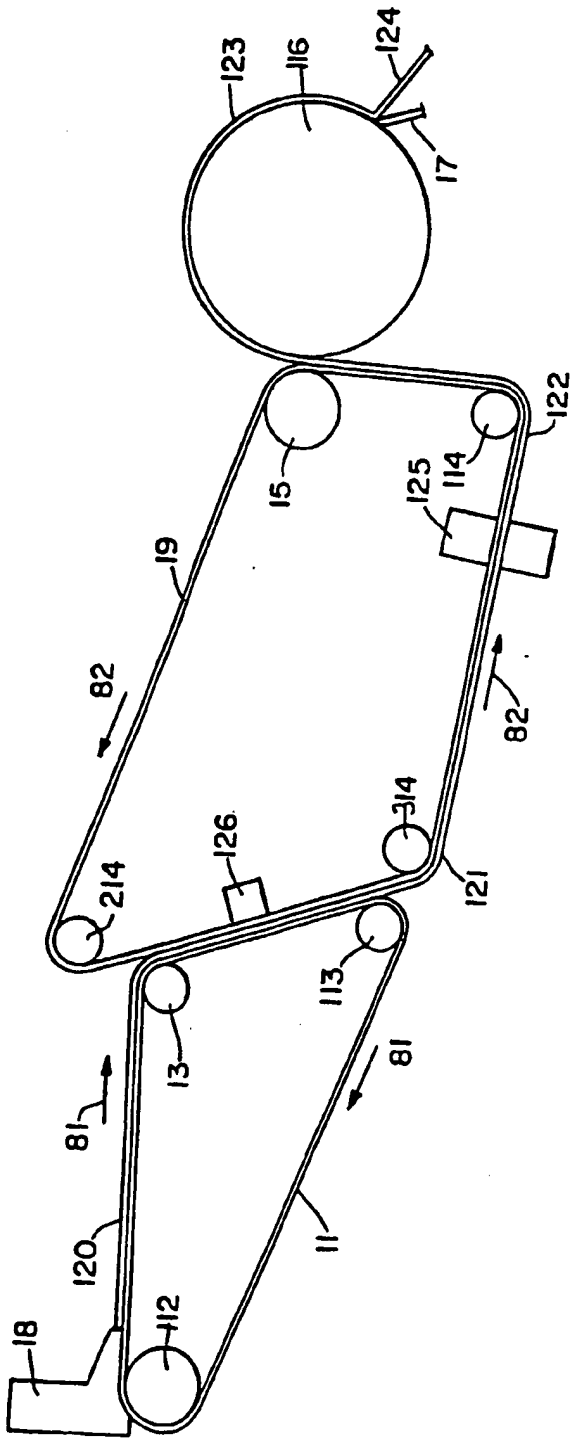
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Fig. 1

Fig 2

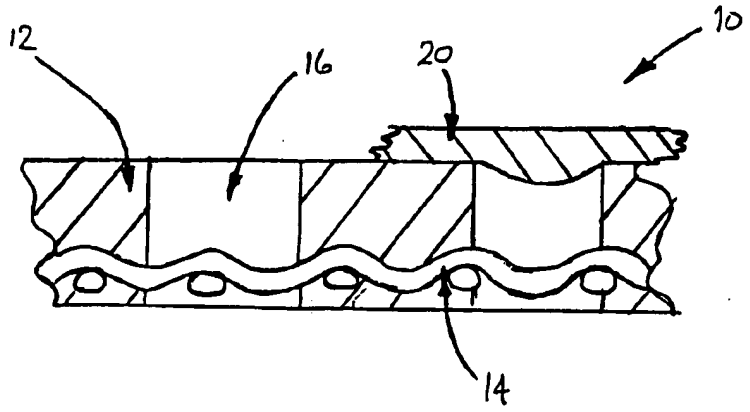
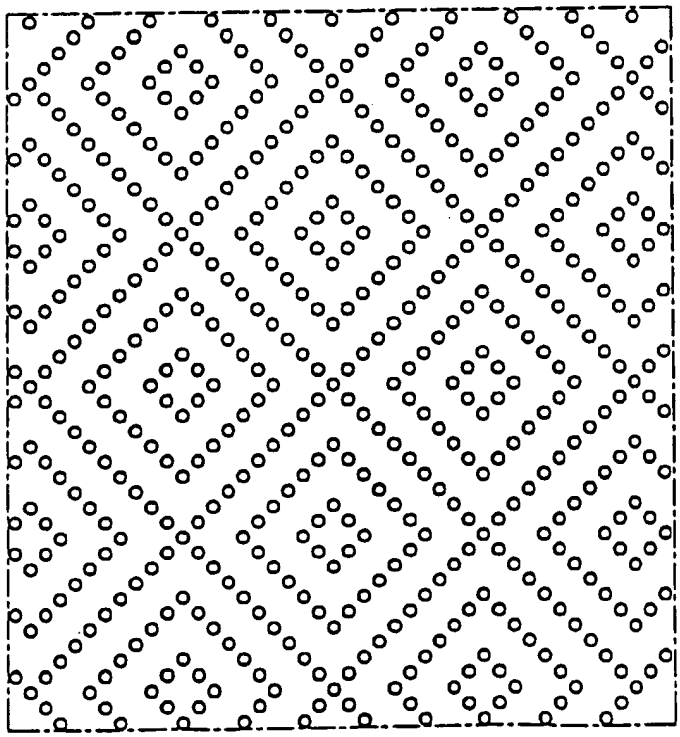


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 98 10 8673

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 668 152 A (KIMBERLY-CLARK CORPORATION) 23 August 1995 * the whole document *	1,2,4,6, 7,9,11, 12,14,16	D21F11/00
D,A	EP 0 140 404 A (THE PROCTOR & GAMBLE COMPANY) 8 May 1985 * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 October 1998	De Rijck, F

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